

WHAT IS CLAIMED IS:

1. An image forming apparatus comprising:
 - a plurality of image carriers;
 - a color image forming unit that sequentially transfers toner
 - 5 images formed on each of the image carriers onto a recording medium that is carried on a transfer belt to form a color image;
 - an optical detecting unit that transfers a reference pattern for density detection formed on each of the image carriers for each color onto the transfer belt, and detects the reference pattern transferred;
 - 10 and
 - an image density control unit that controls image density based on a result of the detection by the optical detecting unit, wherein
 - the optical detecting unit detects both regular reflection light and diffuse reflection light from a detection target simultaneously, and
 - 15 the image density control unit controls the image density based on a value obtained by subtracting a result of multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the regular reflection output of the reference pattern for each color detected by the
 - 20 optical detecting unit.
2. The image forming apparatus according to claim 1, wherein the image density control unit controls the image density based on a relative ratio between the value obtained by subtracting the result of
- 25 multiplying the diffuse reflection output by a minimum value of a ratio

between the regular reflection output and the diffuse reflection output from the regular reflection output of the reference pattern for each color detected by the optical detecting unit, and a value obtained by subtracting a result of multiplying the diffuse reflection output by a
5 minimum value of a ratio between the regular reflection output and the diffuse reflection output from the regular reflection output in a background of the transfer belt, detected by the optical detecting unit.

3. The image forming apparatus according to claim 1, wherein
10 the optical detecting unit includes a light source that emits light, and
the image density control unit uses a difference between the regular reflection output at an ON time of the light source and the regular reflection output at an OFF time of the light source as the
15 regular reflection output.

4. The image forming apparatus according to claim 1, wherein
the optical detecting unit includes a light source that emits light, and
20 the image density control unit uses a difference between the diffuse reflection output at an ON time of the light source and the diffuse reflection output at an OFF time of the light source as the diffuse reflection output.

25 5. The image forming apparatus according to claim 1, wherein

the optical detecting unit includes a first photodetector that receives the regular reflection light from the detection target, and a second photodetector that receives the diffuse reflection light from the detection target, and

5 light-output characteristics of the two photodetectors are the same.

6. The image forming apparatus according to claim 1, wherein the optical detecting unit detects light from three or more of the reference
10 patterns formed for each color.

7. The image forming apparatus according to claim 1, wherein the optical detecting unit is arranged not to be opposite to the recording medium carried.
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8. The image forming apparatus according to claim 1, wherein the optical detecting unit further detects a misalignment of the transfer belt.

9. An image forming apparatus comprising:
20 a plurality of image carriers;
a color image forming unit that sequentially transfers toner images formed on each of the image carriers onto an intermediate transfer body to form a color image on the intermediate transfer body, and collectively transfers the color image onto a recording medium;
25 an optical detecting unit that transfers a reference pattern for

density detection formed on each of the image carriers for each color onto the intermediate transfer body, and detects the reference pattern transferred; and

an image density control unit that controls image density based
5 on a result of the detection by the optical detecting unit, wherein

the optical detecting unit detects both regular reflection light and diffuse reflection light from a detection target simultaneously, and

the image density control unit controls the image density based on a value obtained by subtracting a result of multiplying a diffuse
10 reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the regular reflection output of the reference pattern for each color detected by the optical detecting unit.

15 10. The image forming apparatus according to claim 9, wherein the image density control unit controls the image density based on a relative ratio between the value obtained by subtracting the result of multiplying the diffuse reflection output by a minimum value of a ratio between the regular reflection output and the diffuse reflection output
20 from the regular reflection output of the reference pattern for each color detected by the optical detecting unit, and a value obtained by subtracting a result of multiplying the diffuse reflection output by a minimum value of a ratio between the regular reflection output and the diffuse reflection output from the regular reflection output in a
25 background of the intermediate transfer body, detected by the optical

detecting unit.

11. The image forming apparatus according to claim 9, wherein
the optical detecting unit includes a light source that emits light,

5 and

the image density control unit uses a difference between the
regular reflection output at an ON time of the light source and the
regular reflection output at an OFF time of the light source as the
regular reflection output.

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12. The image forming apparatus according to claim 9, wherein
the optical detecting unit includes a light source that emits light,

and

the image density control unit uses a difference between the

15 diffuse reflection output at an ON time of the light source and the
diffuse reflection output at an OFF time of the light source as the diffuse
reflection output.

13. The image forming apparatus according to claim 9, wherein

20 the optical detecting unit includes a first photodetector that
receives the regular reflection light from the detection target, and a
second photodetector that receives the diffuse reflection light from the
detection target, and

light-output characteristics of the two photodetectors are the
25 same.

14. The image forming apparatus according to claim 9, wherein the optical detecting unit detects light from three or more of the reference patterns formed for each color.

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15. The image forming apparatus according to claim 9, wherein the optical detecting unit is arranged not to be opposite to the recording medium carried.

10 16. The image forming apparatus according to claim 9, wherein the optical detecting unit further detects a misalignment of the intermediate transfer body.

17. An image forming apparatus comprising:

15 an image carrier;

a color image forming unit that repeatedly transfers a toner image formed on the image carrier onto an intermediate transfer body to form a color image, and collectively transfers the color images onto a recording medium;

20 an optical detecting unit that transfers a reference pattern for density detection formed on each of the image carriers for each color onto the intermediate transfer body, and detects the reference pattern transferred; and

an image density control unit that controls image density based
25 on a result of the detection by the optical detecting unit, wherein

the optical detecting unit detects both regular reflection light and diffuse reflection light from a detection target simultaneously, and

the image density control unit controls the image density based on a value obtained by subtracting a result of multiplying a diffuse
5 reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the regular reflection output of the reference pattern for each color detected by the optical detecting unit.

10 18. The image forming apparatus according to claim 17, wherein the image density control unit controls the image density based on a relative ratio between the value obtained by subtracting the result of multiplying the diffuse reflection output by a minimum value of a ratio between the regular reflection output and the diffuse reflection output
15 from the regular reflection output of the reference pattern for each color detected by the optical detecting unit, and a value obtained by subtracting a result of multiplying the diffuse reflection output by a minimum value of a ratio between the regular reflection output and the diffuse reflection output from the regular reflection output in a
20 background of the intermediate transfer body, detected by the optical detecting unit.

19. The image forming apparatus according to claim 17, wherein
the optical detecting unit includes a light source that emits light,
25 and

the image density control unit uses a difference between the regular reflection output at an ON time of the light source and the regular reflection output at an OFF time of the light source as the regular reflection output.

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20. The image forming apparatus according to claim 17, wherein the optical detecting unit includes a light source that emits light, and

the image density control unit uses a difference between the
10 diffuse reflection output at an ON time of the light source and the diffuse reflection output at an OFF time of the light source as the diffuse reflection output.

21. The image forming apparatus according to claim 17, wherein
15 the optical detecting unit includes a first photodetector that receives the regular reflection light from the detection target, and a second photodetector that receives the diffuse reflection light from the detection target, and

light-output characteristics of the two photodetectors are the
20 same.

22. The image forming apparatus according to claim 17, wherein the optical detecting unit detects light from three or more of the reference patterns formed for each color.

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23. The image forming apparatus according to claim 17, wherein the optical detecting unit is arranged not to be opposite to the recording medium carried.

5 24. The image forming apparatus according to claim 17, wherein the optical detecting unit further detects a misalignment of the intermediate transfer body.

25. A method of calculating an amount of toner transfer on a
10 reference pattern by detecting the reference pattern transferred onto a transfer belt or an intermediate transfer body from an image carrier, comprising:

detecting both regular reflection light and diffuse reflection light from a detection target simultaneously; and

15 calculating the amount of toner transfer on the reference pattern based on a relative ratio between a value obtained by subtracting a result of multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the regular reflection output of the reference pattern, and a
20 value obtained by subtracting a result of multiplying the diffuse reflection output by a minimum value of a ratio between the regular reflection output and the diffuse reflection output from the regular reflection output in a background of the transfer belt or the intermediate transfer body.

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26. A method of converting a regular reflection output into an amount of toner transfer, comprising:

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different
5 amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light
10 component;

converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection
15 of the amount of toner transfer by the regular reflection light is possible.

27. A method of converting a regular reflection output into an amount of toner transfer, comprising:

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different
20 amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection
25 output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a
5 normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

10 28. A method of converting a regular reflection output into an amount of toner transfer, comprising:

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light
15 and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

20 multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

25 converting a ratio between a result of the subtracting and the

regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection
5 of the amount of toner transfer by the regular reflection light is possible.

29. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

detecting optically a plurality of gradation patterns of toner
10 formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the
15 regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value;

multiplying the normalized value by a background diffuse
20 reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse-reflection-output conversion value by subtracting a result of the multiplying from the diffuse reflection output;
and

25 acquiring a first-order linear relation between the

diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

- 5 30. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light
10 and diffuse reflection light simultaneously from the detection target;

 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

 subtracting a result of the multiplying from the regular reflection
15 output;

 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

 multiplying the normalized value by a background diffuse
20 reflection output directly reflected from a background of the surface of the detection target;

 obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

 acquiring a first-order linear relation between the
25 diffuse-reflection-output conversion value and the amount of toner

transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

31. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by
subtracting
a result of multiplying from the diffuse reflection output increment; and
acquiring a first-order linear relation between the
5 diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

32. A method of converting a diffuse reflection output into an
10 amount of toner transfer, comprising:
converting the diffuse reflection output conversion value into the
amount of toner transfer by multiplying a correction factor by which the
diffuse reflection output conversion value corresponding to an arbitrary
regular reflection output conversion value becomes a predetermined
15 value, based on a first-order linear relation between a regular reflection
output conversion value obtained by a method that includes
detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
different amount of toner transferred by detecting both regular reflection
20 light and diffuse reflection light simultaneously from the detection
target;
extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
detected into the regular reflection light component and a diffuse
25 reflection light component;

converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse-reflection-output conversion value by subtracting a result of the multiplying from the diffuse reflection output;

and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

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33. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the
10 diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of
15 toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by
20 separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

25 acquiring a first-order linear relation between the

normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a
5 method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection

10 target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular
15 reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

multiplying the normalized value by a background diffuse
20 reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the
25 diffuse-reflection-output conversion value and the amount of toner

transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

34. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection

light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by

subtracting

a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the

diffuse-reflection-output conversion value and the amount of toner

- 5 transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

35. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

- 10 converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection
- 15 output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection

- 20 target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

- 25 subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the
5 normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

10 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

15 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a
20 normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse-reflection-output conversion value by
25 subtracting a result of the multiplying from the diffuse reflection output;

and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
5 transfer by the regular reflection light is possible.

36. A method of converting a diffuse reflection output into an
amount of toner transfer, comprising:

converting the diffuse reflection output conversion value into the
10 amount of toner transfer by multiplying a correction factor by which the
diffuse reflection output conversion value corresponding to an arbitrary
regular reflection output conversion value becomes a predetermined
value, based on a first-order linear relation between a regular reflection
output conversion value obtained by a method that includes

15 detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
different amount of toner transferred by detecting both regular reflection
light and diffuse reflection light simultaneously from the detection
target;

20 multiplying a diffuse reflection output by a minimum
value of a ratio between a regular reflection output and the diffuse
reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular
reflection output;

25 converting a ratio between a result of the subtracting and

the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by

subtracting a result of multiplying from the diffuse reflection output; and
acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
5 transfer by the regular reflection light is possible.

37. A method of converting a diffuse reflection output into an
amount of toner transfer, comprising:

converting the diffuse reflection output conversion value into the
10 amount of toner transfer by multiplying a correction factor by which the
diffuse reflection output conversion value corresponding to an arbitrary
regular reflection output conversion value becomes a predetermined
value, based on a first-order linear relation between a regular reflection
output conversion value obtained by a method that includes

15 detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
different amount of toner transferred by detecting both regular reflection
light and diffuse reflection light simultaneously from the detection
target;

20 multiplying a diffuse reflection output by a minimum
value of a ratio between a regular reflection output and the diffuse
reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular
reflection output;

25 converting a ratio between a result of the subtracting and

the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

5 obtaining a diffuse reflection output conversion value by subtracting

a result of multiplying from the diffuse reflection output increment; and

 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner

10 transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

38. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

15 converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection

20 output conversion value obtained by a method that includes

 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection

25 target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

5 multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

10 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

15 and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern

25

detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value;

5 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse-reflection-output conversion value by subtracting a result of the multiplying from the diffuse reflection output;

10 and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

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39. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the
20 diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

25 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with

different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a
5 diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a
minimum value of a ratio between the regular reflection output
10 increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection
15 target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

20 and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection
25 light and diffuse reflection light simultaneously from the detection

target;

 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

5 subtracting a result of the multiplying from the regular reflection output;

 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

10 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

 obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

15 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

20 40. A method of converting a diffuse reflection output into an amount of toner transfer, comprising:

 converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary

25 regular reflection output conversion value becomes a predetermined

value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with

5 different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output

10 values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

15 subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

20 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a

25 method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection
5 target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

10 multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

15 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the
20 diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting
a result of multiplying from the diffuse reflection output increment; and

25 acquiring a first-order linear relation between the

diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

- 5 41. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein
- 10 a method of converting a regular reflection output into an amount of toner transfer is executed by using the transfer body as the detection target and toner as the powder, the method including
- detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection
- 15 target;
- extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;
- 20 converting the regular reflection light component into a normalized value; and
- acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection
- 25 light is possible.

42. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein

5 a method of converting a regular reflection output into an amount of toner transfer is executed by using the transfer body as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with

10 different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse

15 reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into

20 a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

25

43. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein

5 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the transfer body as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection

10 light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at

15 an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular

20 reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the

25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible.

44. An image forming apparatus that forms a color image by
5 sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein
a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the transfer body as the detection target and toner as the powder, the method including
10 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
15 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;
converting the regular reflection light component into a
20 normalized value;
multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;
obtaining a diffuse-reflection-output conversion value by
25 subtracting a result of the multiplying from the diffuse reflection output;

and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
5 transfer by the regular reflection light is possible.

45. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
carriers onto a recording medium carried on a transfer body, wherein
10 a method of converting a diffuse reflection output into an amount
of toner transfer is executed by using the transfer body as the detection
target and toner as the powder, the method including
detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
15 different amount of toner transferred by detecting both regular reflection
light and diffuse reflection light simultaneously from the detection
target;
multiplying a diffuse reflection output by a minimum
value of a ratio between a regular reflection output and the diffuse
20 reflection output from the gradation pattern detected;
subtracting a result of the multiplying from the regular
reflection output;
converting a ratio between a result of the subtracting and
the regular reflection output from the surface of the detection target into
25 a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by
5 subtracting a result of multiplying from the diffuse reflection output; and
acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

10

46. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein
a method of converting a diffuse reflection output into an amount
15 of toner transfer is executed by using the transfer body as the detection target and toner as the powder, the method including
detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection
20 light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at
25 an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

5 subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

10 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

15 a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

20

47. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein

25 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the transfer body as the detection

target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an

5 arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation

10 patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by

15 separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

20 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained

25 by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
5 detection target;

extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
detected into the regular reflection light component and a diffuse
reflection light component;

10 converting the regular reflection light component
into a normalized value;

multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
surface of the detection target;

15 obtaining a diffuse-reflection-output conversion
value by subtracting a result of the multiplying from the diffuse
reflection output; and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
20 transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

48. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
25 carriers onto a recording medium carried on a transfer body, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the transfer body as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value

5 into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that

10 includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the

15 detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

20 converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection

25 light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

- detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
5 with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;
- multiplying a diffuse reflection output by a
minimum value of a ratio between a regular reflection output and the
10 diffuse reflection output from the gradation pattern detected;
- subtracting a result of the multiplying from the
regular reflection output;
- converting a ratio between a result of the
subtracting and the regular reflection output from the surface of the
15 detection target into a normalized value;
- multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
surface of the detection target;
- obtaining a diffuse reflection output conversion
20 value by subtracting a result of multiplying from the diffuse reflection
output; and
- acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
25 transfer by the regular reflection light is possible.

49. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein

5 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the transfer body as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by

10 which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

15 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component

25 into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

5 and a diffuse reflection output conversion value obtained by a method that includes

 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular

10 reflection light and diffuse reflection light simultaneously from the detection target;

 obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting

15 and at an OFF time of the light source;

 multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

 subtracting a result of the multiplying from the

20 regular reflection output increment;

 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

 multiplying the normalized value by the a diffuse

25 reflection output increment obtained from a difference between the

diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

- 5 a result of multiplying from the diffuse reflection output increment; and
acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

10

50. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
carriers onto a recording medium carried on a transfer body, wherein
a method of converting a diffuse reflection output into an amount

- 15 of toner transfer is executed by using the transfer body as the detection
target and toner as the powder, the method including

- converting the diffuse reflection output conversion value
into the amount of toner transfer by multiplying a correction factor by
which the diffuse reflection output conversion value corresponding to an
20 arbitrary regular reflection output conversion value becomes a
predetermined value, based on a first-order linear relation between a
regular reflection output conversion value obtained by a method that
includes

- detecting optically a plurality of gradation
25 patterns of toner formed continuously on a surface of a detection target

with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

5 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

10 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

15 and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse

- reflection light component;
- converting the regular reflection light component into a normalized value;
- multiplying the normalized value by a background
- 5 diffuse reflection output directly reflected from a background of the surface of the detection target;
- obtaining a diffuse-reflection-output conversion value by subtracting a result of the multiplying from the diffuse reflection output; and
- 10 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.
- 15 51. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein
- a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the transfer body as the detection
- 20 target and toner as the powder, the method including
- converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
- 25 predetermined value, based on a first-order linear relation between a

regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
5 reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the
10 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the
15 detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

20 and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
25 reflection light and diffuse reflection light simultaneously from the

target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an

5 arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation

10 patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a

15 minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the

20 subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection

25 light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
5 with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
10 output values between at an ON time of a light source for the detecting
and at an OFF time of the light source;

multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

15 subtracting a result of the multiplying from the
regular reflection output increment;

converting a ratio between a result of the
subtracting and the regular reflection output increment from the surface
of the detection target into a normalized value;

20 multiplying the normalized value by the a diffuse
reflection output increment obtained from a difference between the
diffuse reflection output at an ON time of a light source for the detecting
and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion
25 value by subtracting

a result of multiplying from the diffuse reflection output increment; and
acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
5 transfer by the regular reflection light is possible.

53. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
carriers onto a recording medium carried on a transfer body, wherein
10 a method of converting a diffuse reflection output into an amount
of toner transfer is executed by using the transfer body as the detection
target and toner as the powder, the method including
converting the diffuse reflection output conversion value
into the amount of toner transfer by multiplying a correction factor by
15 which the diffuse reflection output conversion value corresponding to an
arbitrary regular reflection output conversion value becomes a
predetermined value, based on a first-order linear relation between a
regular reflection output conversion value obtained by a method that
includes
20 detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;
25 obtaining a regular reflection output increment

and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

5 multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

10 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

15 and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse

- reflection light component;
- converting the regular reflection light component into a normalized value;
- multiplying the normalized value by a background
- 5 diffuse reflection output directly reflected from a background of the surface of the detection target;
- obtaining a diffuse-reflection-output conversion value by subtracting a result of the multiplying from the diffuse reflection output; and
- 10 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.
- 15 54. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein
- a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the transfer body as the detection
- 20 target and toner as the powder, the method including
- converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
- 25 predetermined value, based on a first-order linear relation between a

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
5 detection target;

multiplying a diffuse reflection output by a
minimum value of a ratio between a regular reflection output and the
diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the
10 regular reflection output;

converting a ratio between a result of the
subtracting and the regular reflection output from the surface of the
detection target into a normalized value;

multiplying the normalized value by a background
15 diffuse reflection output directly reflected from a background of the
surface of the detection target;

obtaining a diffuse reflection output conversion
value by subtracting a result of multiplying from the diffuse reflection
output; and

20 acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

25 55. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the transfer body as the detection target, and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a

predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the

regular reflection output increment;

converting a ratio between a result of the
subtracting and the regular reflection output increment from the surface
of the detection target into a normalized value; and

5 acquiring a first-order linear relation between the
normalized value and the amount of toner transfer within a range in
which detection of the amount of toner transfer by the regular reflection
light is possible,

and a diffuse reflection output conversion value obtained
10 by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
15 detection target;

obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
output values between at an ON time of a light source for the detecting
and at an OFF time of the light source;

20 multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the
regular reflection output increment;

25 converting a ratio between a result of the

subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

5 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

a result of multiplying from the diffuse reflection output increment; and

10 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

15 56. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein

a method of converting a regular reflection output into an amount of toner transfer is executed by using the image carriers as the

20 detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection

25 target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

5 converting the regular reflection light component into a normalized value; and

 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection
10 light is possible.

57. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein
15 a method of converting a regular reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with
20 different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse
25 reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into
5 a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

10

58. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein
a method of converting a diffuse reflection output into an amount

15 of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection
20 light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at
25 an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

5 subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

10 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

59. An image forming apparatus that forms a color image by
15 sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein
a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
20 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

25 extracting a regular reflection light component by

separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

5 converting the regular reflection light component into a normalized value;

 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

 obtaining a diffuse-reflection-output conversion value by
10 subtracting a result of the multiplying from the diffuse reflection output;
and

 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner
15 transfer by the regular reflection light is possible.

60. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein
20 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with
25 different amount of toner transferred by detecting both regular reflection

light and diffuse reflection light simultaneously from the detection target;

5 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

10 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

15 obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

20

61. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein a method of converting a diffuse reflection output into an amount

25 of toner transfer is executed by using the image carriers as the

detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection

5 light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at

10 an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular

15 reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

multiplying the normalized value by the a diffuse

20 reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

25 a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

5

62. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein a method of converting a diffuse reflection output into an amount

10 of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
15 predetermined value; based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation
20 patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by
25 separating a regular reflection output from the gradation pattern

detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

5 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained
10 by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
15 detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

20 converting the regular reflection light component into a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

25 obtaining a diffuse-reflection-output conversion

value by subtracting a result of the multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

63. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
surface of the detection target;

obtaining a diffuse reflection output conversion
5 value by subtracting a result of multiplying from the diffuse reflection
output; and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
10 transfer by the regular reflection light is possible.

64. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
carriers onto a recording medium carried on an image carriers, wherein
15 a method of converting a diffuse reflection output into an amount
of toner transfer is executed by using the image carriers as the
detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
into the amount of toner transfer by multiplying a correction factor by
20 which the diffuse reflection output conversion value corresponding to an
arbitrary regular reflection output conversion value becomes a
predetermined value, based on a first-order linear relation between a
regular reflection output conversion value obtained by a method that
includes

25 detecting optically a plurality of gradation

patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

5 extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
detected into the regular reflection light component and a diffuse
reflection light component;

converting the regular reflection light component
10 into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible;

15 and a diffuse reflection output conversion value obtained
by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
20 reflection light and diffuse reflection light simultaneously from the
detection target;

obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
output values between at an ON time of a light source for the detecting
25 and at an OFF time of the light source;

multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the
5 regular reflection output increment;

converting a ratio between a result of the
subtracting and the regular reflection output increment from the surface
of the detection target into a normalized value;

multiplying the normalized value by the a diffuse
10 reflection output increment obtained from a difference between the
diffuse reflection output at an ON time of a light source for the detecting
and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion
value by subtracting
15 a result of multiplying from the diffuse reflection output increment; and
acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

20

65. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
carriers onto a recording medium carried on an image carriers, wherein
a method of converting a diffuse reflection output into an amount

25 of toner transfer is executed by using the image carriers as the

detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value

into the amount of toner transfer by multiplying a correction factor by

which the diffuse reflection output conversion value corresponding to an

5 arbitrary regular reflection output conversion value becomes a

predetermined value, based on a first-order linear relation between a

regular reflection output conversion value obtained by a method that

includes

detecting optically a plurality of gradation

10 patterns of toner formed continuously on a surface of a detection target

with different amount of toner transferred by detecting both regular

reflection light and diffuse reflection light simultaneously from the

detection target;

multiplying a diffuse reflection output by a

15 minimum value of a ratio between a regular reflection output and the

diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the

regular reflection output;

converting a ratio between a result of the

20 subtracting and the regular reflection output from the surface of the

detection target into a normalized value; and

acquiring a first-order linear relation between the

normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection

25 light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
5 with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
10 detected into the regular reflection light component and a diffuse
reflection light component;

converting the regular reflection light component
into a normalized value;

15 multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
surface of the detection target;

obtaining a diffuse-reflection-output conversion
value by subtracting a result of the multiplying from the diffuse
reflection output; and

20 acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

25 66. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the

5 detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a

10 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target

15 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the

20 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the

25 detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

5 and a diffuse reflection output conversion value obtained by a method that includes

 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
10 reflection light and diffuse reflection light simultaneously from the detection target;

 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

15 subtracting a result of the multiplying from the regular reflection output;

 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

20 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

 obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection
25 output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

5

67. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
- 10 converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
- 15 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes
- detecting optically a plurality of gradation
- 20 patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
- multiplying a diffuse reflection output by a
- 25 minimum value of a ratio between a regular reflection output and the

diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the

5 subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection

10 light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target

15 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each

20 output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

25 subtracting a result of the multiplying from the

regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

5 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion
10 value by subtracting
a result of multiplying from the diffuse reflection output increment; and
acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
15 transfer by the regular reflection light is possible.

68. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein
20 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
into the amount of toner transfer by multiplying a correction factor by
25 which the diffuse reflection output conversion value corresponding to an

and a diffuse reflection output conversion value obtained
by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
5 with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
10 detected into the regular reflection light component and a diffuse
reflection light component;

converting the regular reflection light component
into a normalized value;

15 multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
surface of the detection target;

obtaining a diffuse-reflection-output conversion
value by subtracting a result of the multiplying from the diffuse
reflection output; and

20 acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

25 69. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the

5 detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a

10 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target

15 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each

20 output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

25 subtracting a result of the multiplying from the

regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

5 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained

10 by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the

15 detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the

20 regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

multiplying the normalized value by a background

25 diffuse reflection output directly reflected from a background of the

surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

5 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

10 70. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on an image carriers, wherein a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the
15 detection target and toner as the powder, the method including converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
20 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
25 with different amount of toner transferred by detecting both regular

reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each

5 output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

10 subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

15 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained
20 by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
25 detection target;

obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
output values between at an ON time of a light source for the detecting
and at an OFF time of the light source;

5 multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

 subtracting a result of the multiplying from the
regular reflection output increment;

10 converting a ratio between a result of the
subtracting and the regular reflection output increment from the surface
of the detection target into a normalized value;

 multiplying the normalized value by the a diffuse
reflection output increment obtained from a difference between the
15 diffuse reflection output at an ON time of a light source for the detecting
and the diffuse reflection output at an OFF time of the light source;

 obtaining a diffuse reflection output conversion
value by subtracting

a result of multiplying from the diffuse reflection output increment; and

20 acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

25 71. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a regular reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

72. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image

carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a regular reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

73. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount
5 of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection
10 light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at
15 an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular
20 reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the
25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible.

74. An image forming apparatus that forms a color image by
5 sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as
10 the detection target and toner as the powder, the method including
- detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection
15 target;
- extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;
- 20 converting the regular reflection light component into a normalized value;
- multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;
- 25 obtaining a diffuse-reflection-output conversion value by

subtracting a result of the multiplying from the diffuse reflection output;
and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
5 transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

75. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
10 carriers onto an intermediate transfer body, and collectively transfers
the color image onto a recording medium, wherein
a method of converting a diffuse reflection output into an amount
of toner transfer is executed by using the intermediate transfer body as
the detection target and toner as the powder, the method including
15 detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
different amount of toner transferred by detecting both regular reflection
light and diffuse reflection light simultaneously from the detection
target;
20 multiplying a diffuse reflection output by a minimum
value of a ratio between a regular reflection output and the diffuse
reflection output from the gradation pattern detected;
subtracting a result of the multiplying from the regular
reflection output;
25 converting a ratio between a result of the subtracting and

the regular reflection output from the surface of the detection target into a normalized value;

5 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

10 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

76. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image
15 carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including
20 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

25 obtaining a regular reflection output increment and a

diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

5 multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

10 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

15 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output increment; and

20 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

77. An image forming apparatus that forms a color image by
25 sequentially superposing toner images formed on a plurality of image

carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as
5 the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
10 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
15 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern
20 detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the
25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

5 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

10 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component
15 into a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse-reflection-output conversion
20 value by subtracting a result of the multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner
25 transfer by the regular reflection light is possible.

78. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers
5 the color image onto a recording medium, wherein
a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
10 into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that
15 includes
detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
20 detection target;
extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;
25 converting the regular reflection light component

into a normalized value; and

acquiring a first-order linear relation between the
normalized value and the amount of toner transfer within a range in
which detection of the amount of toner transfer by the regular reflection
5 light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
10 with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

multiplying a diffuse reflection output by a
minimum value of a ratio between a regular reflection output and the
15 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the
regular reflection output;

converting a ratio between a result of the
subtracting and the regular reflection output from the surface of the
20 detection target into a normalized value;

multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
surface of the detection target;

obtaining a diffuse reflection output conversion
25 value by subtracting a result of multiplying from the diffuse reflection

output; and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
5 transfer by the regular reflection light is possible.

79. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
carriers onto an intermediate transfer body, and collectively transfers
10 the color image onto a recording medium, wherein
a method of converting a diffuse reflection output into an amount
of toner transfer is executed by using the intermediate transfer body as
the detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
15 into the amount of toner transfer by multiplying a correction factor by
which the diffuse reflection output conversion value corresponding to an
arbitrary regular reflection output conversion value becomes a
predetermined value, based on a first-order linear relation between a
regular reflection output conversion value obtained by a method that
20 includes
detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
25 detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

5 converting the regular reflection light component
into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
20 output values between at an ON time of a light source for the detecting
and at an OFF time of the light source;

by multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

25 subtracting a result of the multiplying from the

regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

5 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion
10 value by subtracting
a result of multiplying from the diffuse reflection output increment; and
acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
15 transfer by the regular reflection light is possible.

80. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers
20 the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
25 into the amount of toner transfer by multiplying a correction factor by

which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that
5 includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
10 detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the
15 regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the
20 normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

25 detecting optically a plurality of gradation

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value

5 into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that

10 includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the

15 detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the

20 regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the

25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

5 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

10 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

15 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

20 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

25 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner

transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

82. An image forming apparatus that forms a color image by
5 sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as
10 the detection target and toner as the powder, the method including
- converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
15 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes
- detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
20 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
- multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the
25 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

5 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting
10 a result of multiplying from the diffuse reflection output increment; and acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

15

83. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

20 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by
25 which the diffuse reflection output conversion value corresponding to an

arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

- 5 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
- 10 obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;
 multiplying the diffuse reflection output increment
- 15 by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;
 subtracting a result of the multiplying from the regular reflection output increment;
 converting a ratio between a result of the
- 20 subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and
 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection
- 25 light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
5 with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
10 detected into the regular reflection light component and a diffuse
reflection light component;

converting the regular reflection light component
into a normalized value;

15 multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
surface of the detection target;

obtaining a diffuse-reflection-output conversion
value by subtracting a result of the multiplying from the diffuse
reflection output; and

20 acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

25 84. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount
5 of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
into the amount of toner transfer by multiplying a correction factor by
which the diffuse reflection output conversion value corresponding to an
10 arbitrary regular reflection output conversion value becomes a
predetermined value, based on a first-order linear relation between a
regular reflection output conversion value obtained by a method that
includes

detecting optically a plurality of gradation
15 patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

obtaining a regular reflection output increment
20 and a diffuse reflection output increment from a difference of each
output values between at an ON time of a light source for the detecting
and at an OFF time of the light source;

multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
25 increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

multiplying the normalized value by a background

diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection
5 output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

10

85. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

15 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by

20 which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that including

25 detecting optically a plurality of gradation

patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

5 obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
output values between at an ON time of a light source for the detection
and at an OFF time of the light source;

10 multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the
regular reflection output increment;

15 subtracting and the regular reflection output increment from the surface
of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
25 with different amount of toner transferred by detecting both regular

reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each

5 output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

10 subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

15 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

20 a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner

25 transfer by the regular reflection light is possible.

86. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers
5 the color image onto a recording medium, wherein
a method of converting a regular reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
detecting optically a plurality of gradation patterns of
10 toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
extracting a regular reflection light component by
15 separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;
converting the regular reflection light component into a normalized value; and
20 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

25 87. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a regular reflection output into an
5 amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
different amount of toner transferred by detecting both regular reflection
10 light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum
value of a ratio between a regular reflection output and the diffuse
reflection output from the gradation pattern detected;

15 subtracting a result of the multiplying from the regular
reflection output;

converting a ratio between a result of the subtracting and
the regular reflection output from the surface of the detection target into
a normalized value; and

20 acquiring a first-order linear relation between the
normalized value and the amount of toner transfer within a range in
which detection of the amount of toner transfer by the regular reflection
light is possible.

25 88. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount
5 of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection
10 light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at
15 an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular
20 reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the
25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible.

89. An image forming apparatus that forms a color image by
5 sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the
10 detection target and toner as the powder, the method including
- detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection
15 target;
- extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;
- 20 converting the regular reflection light component into a normalized value;
- multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;
- 25 obtaining a diffuse-reflection-output conversion value by

subtracting a result of the multiplying from the diffuse reflection output;
and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
5 transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

90. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
10 carriers onto an intermediate transfer body, and collectively transfers
the color image onto a recording medium, wherein
a method of converting a diffuse reflection output into an amount
of toner transfer is executed by using the image carriers as the
detection target and toner as the powder, the method including
15 detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
different amount of toner transferred by detecting both regular reflection
light and diffuse reflection light simultaneously from the detection
target;
20 multiplying a diffuse reflection output by a minimum
value of a ratio between a regular reflection output and the diffuse
reflection output from the gradation pattern detected;
subtracting a result of the multiplying from the regular
reflection output;
25 converting a ratio between a result of the subtracting and

the regular reflection output from the surface of the detection target into a normalized value;

5 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

10 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

91. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers
15 the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
20 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

25 obtaining a regular reflection output increment and a

diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

5 multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

10 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

15 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

a result of multiplying from the diffuse reflection output increment; and

20 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

92. An image forming apparatus that forms a color image by
25 sequentially superposing toner images formed on a plurality of image

carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the

5 detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a

10 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
15 reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern
20 detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the
25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

5 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

10 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component
15 into a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse-reflection-output conversion
20 value by subtracting a result of the multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner
25 transfer by the regular reflection light is possible.

93. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers
5 the color image onto a recording medium, wherein
a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
10 into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that
15 includes
detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
20 detection target;
extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;
25 converting the regular reflection light component

into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection

5 light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target

10 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the

15 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the

20 detection target into a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion

25 value by subtracting a result of multiplying from the diffuse reflection

output; and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
5 transfer by the regular reflection light is possible.

94. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
carriers onto an intermediate transfer body, and collectively transfers
10 the color image onto a recording medium, wherein
- a method of converting a diffuse reflection output into an amount
of toner transfer is executed by using the image carriers as the
detection target and toner as the powder, the method including
- converting the diffuse reflection output conversion value
15 into the amount of toner transfer by multiplying a correction factor by
which the diffuse reflection output conversion value corresponding to an
arbitrary regular reflection output conversion value becomes a
predetermined value, based on a first-order linear relation between a
regular reflection output conversion value obtained by a method that
20 includes
- detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
25 detection target;

regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

5 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion
10 value by subtracting
a result of multiplying from the diffuse reflection output increment; and
acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
15 transfer by the regular reflection light is possible.

95. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers
20 the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
25 into the amount of toner transfer by multiplying a correction factor by

which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that
5 includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
10 detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the
15 regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the
20 normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

25 detecting optically a plurality of gradation

patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

5 extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
detected into the regular reflection light component and a diffuse
reflection light component;

converting the regular reflection light component
10 into a normalized value;

multiplying the normalized value by a background
 diffuse reflection output directly reflected from a background of the
 surface of the detection target;

obtaining a diffuse-reflection-output conversion
15 value by subtracting a result of the multiplying from the diffuse
reflection output; and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

96. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value
5 into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that
10 includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
15 detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the
20 regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the
25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

5 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

10 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

 subtracting a result of the multiplying from the regular reflection output;

15 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the
20 surface of the detection target;

 obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

 acquiring a first-order linear relation between the
25 diffuse-reflection-output conversion value and the amount of toner

transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

97. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- 5 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
- 10 converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
- 15 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes
- detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
- 20 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
- multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the
- 25 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

5 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting
10 a result of multiplying from the diffuse reflection output increment; and acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

15

98. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

20 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by
25 which the diffuse reflection output conversion value corresponding to an

arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

- 5 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
- 10 obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;
 multiplying the diffuse reflection output increment
- 15 by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;
 subtracting a result of the multiplying from the regular reflection output increment;
 converting a ratio between a result of the
- 20 subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and
 acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection
- 25 light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
5 with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
10 detected into the regular reflection light component and a diffuse
reflection light component;

converting the regular reflection light component
into a normalized value;

multiplying the normalized value by a background
15 diffuse reflection output directly reflected from a background of the
surface of the detection target;

obtaining a diffuse-reflection-output conversion
value by subtracting a result of the multiplying from the diffuse
reflection output; and

20 acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

25 99. An image forming apparatus that forms a color image by

sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount
5 of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an
10 arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation
15 patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment
20 and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output
25 increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface
5 of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

10 and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
15 reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

20 subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

25 multiplying the normalized value by a background

diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection
5 output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

10

100. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

15 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by

20 which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that including

25 detecting optically a plurality of gradation

reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each

5 output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

10 subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

15 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

20 a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner

25 transfer by the regular reflection light is possible.

101. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image
5 onto a recording medium, wherein

a method of converting a regular reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

10 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

15 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a
20 normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

25

102. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

5 a method of converting a regular reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of
10 toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

15 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

20 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection
25 light is possible.

103. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image
5 onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of
10 toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a
15 diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output
20 increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection
25 target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

5

104. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

10 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with

15 different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern

20 detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value;

25 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of

the detection target;

obtaining a diffuse-reflection-output conversion value by
subtracting a result of the multiplying from the diffuse reflection output;
and

5 acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

10 105. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on an image carrier onto
an intermediate transfer body, and collectively transfers the color image
onto a recording medium, wherein

 a method of converting a diffuse reflection output into an amount
15 of toner transfer is executed by using the intermediate transfer body as
the detection target and toner as the powder, the method including
 detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
different amount of toner transferred by detecting both regular reflection
20 light and diffuse reflection light simultaneously from the detection
target;

 multiplying a diffuse reflection output by a minimum
value of a ratio between a regular reflection output and the diffuse
reflection output from the gradation pattern detected;

25 subtracting a result of the multiplying from the regular

reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

5 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

10 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

15 106. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

20 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection
25 light and diffuse reflection light simultaneously from the detection

target;

obtaining a regular reflection output increment and a
diffuse reflection output increment from a difference of each output
values between at an ON time of a light source for the detecting and at
5 an OFF time of the light source;

multiplying the diffuse reflection output increment by a
minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular
10 reflection output increment;

converting a ratio between a result of the subtracting and
the regular reflection output increment from the surface of the detection
target into a normalized value;

multiplying the normalized value by the a diffuse
15 reflection output increment obtained from a difference between the
diffuse reflection output at an ON time of a light source for the detecting
and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by
subtracting

20 a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

25

107. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

5 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by
10 which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

15 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component
25 into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

5 and a diffuse reflection output conversion value obtained by a method that includes

 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular

10 reflection light and diffuse reflection light simultaneously from the detection target;

 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse

15 reflection light component;

 converting the regular reflection light component into a normalized value;

 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the

20 surface of the detection target;

 obtaining a diffuse-reflection-output conversion value by subtracting a result of the multiplying from the diffuse reflection output; and

 acquiring a first-order linear relation between the

25 diffuse-reflection-output conversion value and the amount of toner

transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

108. An image forming apparatus that forms a color image by
- 5 sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as
- 10 the detection target and toner as the powder, the method including
- converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
- 15 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes
- detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
- 20 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
- extracting a regular reflection light component by separating a regular reflection output from the gradation pattern
- 25 detected into the regular reflection light component and a diffuse

reflection light component;

converting the regular reflection light component
into a normalized value; and

acquiring a first-order linear relation between the
5 normalized value and the amount of toner transfer within a range in
which detection of the amount of toner transfer by the regular reflection
light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

10 detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

15 multiplying a diffuse reflection output by a
minimum value of a ratio between a regular reflection output and the
diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the
regular reflection output;

20 converting a ratio between a result of the
subtracting and the regular reflection output from the surface of the
detection target into a normalized value;

multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
25 surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the
5 diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

109. An image forming apparatus that forms a color image by
10 sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as
15 the detection target and toner as the powder, the method including converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
20 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
25 with different amount of toner transferred by detecting both regular

reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern

5 detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the
10 normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

15 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment
25 by a minimum value of a ratio between the regular reflection output

increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

5 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting
10 and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the
15 diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

110. An image forming apparatus that forms a color image by
20 sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as
25 the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
5 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
10 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the
15 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the
20 detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

25 and a diffuse reflection output conversion value obtained

by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
5 reflection light and diffuse reflection light simultaneously from the
detection target;

extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
detected into the regular reflection light component and a diffuse
10 reflection light component;

converting the regular reflection light component
into a normalized value;

multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
15 surface of the detection target;

obtaining a diffuse-reflection-output conversion
value by subtracting a result of the multiplying from the diffuse
reflection output; and

acquiring a first-order linear relation between the
20 diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

111. An image forming apparatus that forms a color image by
25 sequentially superposing toner images formed on an image carrier onto

an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as
5 the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
10 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
15 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the
20 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the
25 detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

5 and a diffuse reflection output conversion value obtained by a method that includes

 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
10 reflection light and diffuse reflection light simultaneously from the detection target;

 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

15 subtracting a result of the multiplying from the regular reflection output;

 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

20 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

 obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection
25 output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

5

112. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

10 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by

15 which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

20 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

25 multiplying a diffuse reflection output by a

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface
5 of the detection target into a normalized value;

multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

10 obtaining a diffuse reflection output conversion value by subtracting

a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner

15 transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

113. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto
20 an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including

25 converting the diffuse reflection output conversion value

into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a
5 regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
10 reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting
15 and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the
20 regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the
25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

5 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

10 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component
15 into a normalized value;

multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
surface of the detection target;

obtaining a diffuse-reflection-output conversion
20 value by subtracting a result of the multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
25 transfer by the regular reflection light is possible.

114. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image
5 onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the intermediate transfer body as the detection target and toner as the powder, the method including
converting the diffuse reflection output conversion value
10 into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that
15 includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
20 detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

25 multiplying the diffuse reflection output increment

by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

5 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in

10 which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation

15 patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a

20 minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the

25 subtracting and the regular reflection output from the surface of the

including

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
5 reflection light and diffuse reflection light simultaneously from the
detection target;

obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
output values between at an ON time of a light source for the detecting
10 and at an OFF time of the light source;

multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the
15 regular reflection output increment;

converting a ratio between a result of the
subtracting and the regular reflection output increment from the surface
of the detection target into a normalized value; and

acquiring a first-order linear relation between the
20 normalized value and the amount of toner transfer within a range in
which detection of the amount of toner transfer by the regular reflection
light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

25 detecting optically a plurality of gradation

transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

116. An image forming apparatus that forms a color image by
5 sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- a method of converting a regular reflection output into an amount of toner transfer is executed by using the image carriers as the
10 detection target and toner as the powder, the method including
- detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection
15 target;
- extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;
- 20 converting the regular reflection light component into a normalized value; and
- acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection
25 light is possible.

117. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image
5 onto a recording medium, wherein
a method of converting a regular reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including
detecting optically a plurality of gradation patterns of
10 toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
multiplying a diffuse reflection output by a minimum
15 value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;
subtracting a result of the multiplying from the regular reflection output;
converting a ratio between a result of the subtracting and
20 the regular reflection output from the surface of the detection target into a normalized value; and
acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection
25 light is possible.

118. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image
5 onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of
10 toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a
15 diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output
20 increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection
25 target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

5

119. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

10 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with

15 different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern

20 detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value;

25 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of

the detection target;

obtaining a diffuse-reflection-output conversion value by
subtracting a result of the multiplying from the diffuse reflection output;
and

5 acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

10 120. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on an image carrier onto
an intermediate transfer body, and collectively transfers the color image
onto a recording medium, wherein

 a method of converting a diffuse reflection output into an amount
15 of toner transfer is executed by using the image carriers as the
detection target and toner as the powder, the method including
 detecting optically a plurality of gradation patterns of
toner formed continuously on a surface of a detection target with
different amount of toner transferred by detecting both regular reflection
20 light and diffuse reflection light simultaneously from the detection
target;

 multiplying a diffuse reflection output by a minimum
value of a ratio between a regular reflection output and the diffuse
reflection output from the gradation pattern detected;

25 subtracting a result of the multiplying from the regular

reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

5 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

10 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

15 121. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

20 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection

25

target;

obtaining a regular reflection output increment and a
diffuse reflection output increment from a difference of each output
values between at an ON time of a light source for the detecting and at
5 an OFF time of the light source;

multiplying the diffuse reflection output increment by a
minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular
10 reflection output increment;

converting a ratio between a result of the subtracting and
the regular reflection output increment from the surface of the detection
target into a normalized value;

multiplying the normalized value by the a diffuse
15 reflection output increment obtained from a difference between the
diffuse reflection output at an ON time of a light source for the detecting
and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by
subtracting

20 a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the
diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

25

122. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

5 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by
10 which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

15 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component
25 into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

5 and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular

10 reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse

15 reflection light component;

converting the regular reflection light component into a normalized value;

multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the

20 surface of the detection target;

obtaining a diffuse-reflection-output conversion value by subtracting a result of the multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the

25 diffuse-reflection-output conversion value and the amount of toner

transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

123. An image forming apparatus that forms a color image by
- 5 sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the
- 10 detection target and toner as the powder, the method including
- converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
- 15 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes
- detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
- 20 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;
- extracting a regular reflection light component by separating a regular reflection output from the gradation pattern
- 25 detected into the regular reflection light component and a diffuse

reflection light component;

converting the regular reflection light component
into a normalized value; and

acquiring a first-order linear relation between the
5 normalized value and the amount of toner transfer within a range in
which detection of the amount of toner transfer by the regular reflection
light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

10 detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
reflection light and diffuse reflection light simultaneously from the
detection target;

15 multiplying a diffuse reflection output by a
minimum value of a ratio between a regular reflection output and the
diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the
regular reflection output;

20 converting a ratio between a result of the
subtracting and the regular reflection output from the surface of the
detection target into a normalized value;

multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
25 surface of the detection target;

obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection output; and

acquiring a first-order linear relation between the
5 diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

124. An image forming apparatus that forms a color image by
10 sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the
15 detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
20 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
25 with different amount of toner transferred by detecting both regular

reflection light and diffuse reflection light simultaneously from the detection target;

extracting a regular reflection light component by separating a regular reflection output from the gradation pattern

5 detected into the regular reflection light component and a diffuse reflection light component;

converting the regular reflection light component into a normalized value; and

acquiring a first-order linear relation between the
10 normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

15 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

multiplying the diffuse reflection output increment
25 by a minimum value of a ratio between the regular reflection output

increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

5 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value;

multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting
10 and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the
15 diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

125. An image forming apparatus that forms a color image by
20 sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the
25 detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a
5 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target
10 with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the
15 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the
20 detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

25 and a diffuse reflection output conversion value obtained

by a method that includes

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
5 reflection light and diffuse reflection light simultaneously from the
detection target;

extracting a regular reflection light component by
separating a regular reflection output from the gradation pattern
detected into the regular reflection light component and a diffuse
10 reflection light component;

converting the regular reflection light component
into a normalized value;

multiplying the normalized value by a background
diffuse reflection output directly reflected from a background of the
15 surface of the detection target;

obtaining a diffuse-reflection-output conversion
value by subtracting a result of the multiplying from the diffuse
reflection output; and

acquiring a first-order linear relation between the
20 diffuse-reflection-output conversion value and the amount of toner
transfer within a range in which detection of the amount of toner
transfer by the regular reflection light is possible.

126. An image forming apparatus that forms a color image by
25 sequentially superposing toner images formed on an image carrier onto

an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the

5 detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a

10 predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
15 reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the
20 diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the
25 detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible,

5 and a diffuse reflection output conversion value obtained by a method that includes

 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
10 reflection light and diffuse reflection light simultaneously from the detection target;

 multiplying a diffuse reflection output by a minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

15 subtracting a result of the multiplying from the regular reflection output;

 converting a ratio between a result of the subtracting and the regular reflection output from the surface of the detection target into a normalized value;

20 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

 obtaining a diffuse reflection output conversion value by subtracting a result of multiplying from the diffuse reflection
25 output; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

5

127. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

10 a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value into the amount of toner transfer by multiplying a correction factor by
15 which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that includes

20 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

25 multiplying a diffuse reflection output by a

subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface
5 of the detection target into a normalized value;

multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

10 obtaining a diffuse reflection output conversion value by subtracting

a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner

15 transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

128. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto
20 an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

25 converting the diffuse reflection output conversion value

into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a
5 regular reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular
10 reflection light and diffuse reflection light simultaneously from the detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting
15 and at an OFF time of the light source;

multiplying the diffuse reflection output increment by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

20 subtracting a result of the multiplying from the regular reflection output increment;

converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the
25 normalized value and the amount of toner transfer within a range in

which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

5 detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

10 extracting a regular reflection light component by separating a regular reflection output from the gradation pattern detected into the regular reflection light component and a diffuse reflection light component;

 converting the regular reflection light component
15 into a normalized value;

 multiplying the normalized value by a background diffuse reflection output directly reflected from a background of the surface of the detection target;

 obtaining a diffuse-reflection-output conversion
20 value by subtracting a result of the multiplying from the diffuse reflection output; and

 acquiring a first-order linear relation between the diffuse-reflection-output conversion value and the amount of toner transfer within a range in which detection of the amount of toner
25 transfer by the regular reflection light is possible.

129. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image
5 onto a recording medium, wherein

a method of converting a diffuse reflection output into an amount of toner transfer is executed by using the image carriers as the detection target and toner as the powder, the method including

converting the diffuse reflection output conversion value
10 into the amount of toner transfer by multiplying a correction factor by which the diffuse reflection output conversion value corresponding to an arbitrary regular reflection output conversion value becomes a predetermined value, based on a first-order linear relation between a regular reflection output conversion value obtained by a method that
15 includes

detecting optically a plurality of gradation patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the
20 detection target;

obtaining a regular reflection output increment and a diffuse reflection output increment from a difference of each output values between at an ON time of a light source for the detecting and at an OFF time of the light source;

25 multiplying the diffuse reflection output increment

by a minimum value of a ratio between the regular reflection output increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the regular reflection output increment;

5 converting a ratio between a result of the subtracting and the regular reflection output increment from the surface of the detection target into a normalized value; and

acquiring a first-order linear relation between the normalized value and the amount of toner transfer within a range in
10 which detection of the amount of toner transfer by the regular reflection light is possible,

and a diffuse reflection output conversion value obtained by a method that includes

detecting optically a plurality of gradation
15 patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

multiplying a diffuse reflection output by a
20 minimum value of a ratio between a regular reflection output and the diffuse reflection output from the gradation pattern detected;

subtracting a result of the multiplying from the regular reflection output;

converting a ratio between a result of the subtracting and the regular reflection output from the surface of the
25

including

detecting optically a plurality of gradation
patterns of toner formed continuously on a surface of a detection target
with different amount of toner transferred by detecting both regular
5 reflection light and diffuse reflection light simultaneously from the
detection target;

obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
output values between at an ON time of a light source for the detecting
10 and at an OFF time of the light source;

multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the
15 regular reflection output increment;

converting a ratio between a result of the
subtracting and the regular reflection output increment from the surface
of the detection target into a normalized value; and

acquiring a first-order linear relation between the
20 normalized value and the amount of toner transfer within a range in
which detection of the amount of toner transfer by the regular reflection
light is possible,

and a diffuse reflection output conversion value obtained
by a method that includes

25 detecting optically a plurality of gradation

patterns of toner formed continuously on a surface of a detection target with different amount of toner transferred by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

5 obtaining a regular reflection output increment
and a diffuse reflection output increment from a difference of each
output values between at an ON time of a light source for the detecting
and at an OFF time of the light source;

10 multiplying the diffuse reflection output increment
by a minimum value of a ratio between the regular reflection output
increment and the diffuse reflection output increment;

subtracting a result of the multiplying from the
regular reflection output increment;

15 subtracting and the regular reflection output increment from the surface
of the detection target into a normalized value;

20 multiplying the normalized value by the a diffuse reflection output increment obtained from a difference between the diffuse reflection output at an ON time of a light source for the detecting and the diffuse reflection output at an OFF time of the light source;

obtaining a diffuse reflection output conversion value by subtracting

a result of multiplying from the diffuse reflection output increment; and

acquiring a first-order linear relation between the
25 diffuse-reflection-output conversion value and the amount of toner

transfer within a range in which detection of the amount of toner transfer by the regular reflection light is possible.

131. A method of controlling an image density, comprising:

- 5 forming a plurality of predetermined gradation patterns of powder having different amount of powder transfer continuously on a surface of a detection target;
- detecting optically the gradation patterns;
- acquiring either of detecting data and arithmetic processing data
- 10 based on the detecting data;
- storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in
- 15 density control with the predetermined gradation patterns from among the data acquired in a memory; and
- using the data stored when controlling the image density with fewer patterns.

20 132. A method of controlling an image density, comprising:

- forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;
- detecting optically the gradation patterns by detecting both
- 25 regular reflection light and diffuse reflection light simultaneously from

the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;

storing data that is obtained only by detecting of the
5 predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data obtained from the performing in a memory; and
10 using the data stored when controlling the image density with fewer patterns.

133. A method of controlling an image density, comprising:

forming a plurality of predetermined gradation patterns of toner
15 having different amount of toner transfer continuously on a surface of a detection target;

detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;

storing a coefficient obtained by a process for determining a value unequivocally with respect to the amount of toner transfer from among the data arithmetically processed at the arithmetic processing
25 step, which can be obtained only by detection of the predetermined

gradation patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and

5 using the data stored when controlling the image density with fewer patterns.

134. A method of controlling an image density, comprising:

 forming a plurality of predetermined gradation patterns of toner
10 having different amount of toner transfer continuously on a surface of a detection target;

 detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

15 performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;

 storing a coefficient obtained by a process for determining a value of the amount of toner transfer from among the data arithmetically processed at the arithmetic processing step, which can be obtained
20 only by detection of the predetermined gradation patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and

25 using the data stored when controlling the image density with

fewer patterns.

135. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein
5 a method of controlling an image density is executed by using the transfer body as the detection, the method including forming a plurality of predetermined gradation patterns of powder having different amount of powder transfer continuously on a
10 surface of a detection target;
detecting optically the gradation patterns;
acquiring either of detecting data and arithmetic processing data based on the detecting data;
storing data that is obtained only by detecting of the
15 predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data acquired in a memory; and
20 using the data stored when controlling the image density with fewer patterns.

136. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image
25 carriers onto a recording medium carried on a transfer body, wherein

a method of controlling an image density is executed by using the transfer body as the detection, the method including

forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a

5 surface of a detection target;

detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting
10 data of a regular reflection output and a diffuse reflection output obtained;

storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the
15 predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data obtained from the performing in a memory; and

using the data stored when controlling the image density with fewer patterns.

20

137. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein

a method of controlling an image density is executed by using
25 the transfer body as the detection, the method including

forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;

5 detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;

10 storing a coefficient obtained by a process for determining a value unequivocally with respect to the amount of toner transfer from among the data arithmetically processed at the arithmetic processing step, which can be obtained only by detection of the predetermined gradation patterns, and is necessary for maintaining the
15 accuracy in density control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and

using the data stored when controlling the image density
20 with fewer patterns.

138. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein
25 a method of controlling an image density is executed by using

the transfer body as the detection, the method including

forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;

5 detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output

10 obtained;

storing a coefficient obtained by a process for determining a value of the amount of toner transfer from among the data arithmetically processed at the arithmetic processing step, which can be obtained only by detection of the predetermined gradation patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and

15 using the data stored when controlling the image density with fewer patterns.

139. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein

25 a method of controlling an image density is executed by using

the image carriers as the detection, the method including

forming a plurality of predetermined gradation patterns of powder having different amount of powder transfer continuously on a surface of a detection target;

5 detecting optically the gradation patterns;

acquiring either of detecting data and arithmetic processing data based on the detecting data;

storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining

10 accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data acquired in a memory; and

using the data stored when controlling the image density
15 with fewer patterns.

140. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein

20 a method of controlling an image density is executed by using the image carriers as the detection, the method including

forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;

25 detecting optically the gradation patterns by detecting

both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output

5 obtained;

storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among

10

the data obtained from the performing in a memory; and

using the data stored when controlling the image density with fewer patterns.

15

141. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein a method of controlling an image density is executed by using the image carriers as the detection, the method including

20

forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;

detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously

25

from the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;

storing a coefficient obtained by a process for
5 determining a value unequivocally with respect to the amount of toner transfer from among the data arithmetically processed at the arithmetic processing step, which can be obtained only by detection of the predetermined gradation patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the
10 predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and
using the data stored when controlling the image density with fewer patterns.

15

142. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto a recording medium carried on a transfer body, wherein a method of controlling an image density is executed by using
20 the image carriers as the detection, the method including
forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;
detecting optically the gradation patterns by detecting
25 both regular reflection light and diffuse reflection light simultaneously

from the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;

5 storing a coefficient obtained by a process for determining a value of the amount of toner transfer from among the data arithmetically processed at the arithmetic processing step, which can be obtained only by detection of the predetermined gradation patterns, and is necessary for maintaining the accuracy in density

10 control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and

using the data stored when controlling the image density with fewer patterns.

15

143. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

20 a method of controlling an image density is executed by using the intermediate transfer body as the detection, the method including

forming a plurality of predetermined gradation patterns of powder having different amount of powder transfer continuously on a surface of a detection target;

25 detecting optically the gradation patterns;

acquiring either of detecting data and arithmetic processing data based on the detecting data;

storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data acquired in a memory; and using the data stored when controlling the image density with fewer patterns.

144. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein a method of controlling an image density is executed by using the intermediate transfer body as the detection, the method including forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target; detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target; performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output

obtained;

storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the

5 predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data obtained from the performing in a memory; and

using the data stored when controlling the image density with fewer patterns.

10

145. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

15 a method of controlling an image density is executed by using the intermediate transfer body as the detection, the method including forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;

20 detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output

25 obtained;

storing a coefficient obtained by a process for
determining a value unequivocally with respect to the amount of toner
transfer from among the data arithmetically processed at the arithmetic
processing step, which can be obtained only by detection of the
5 predetermined gradation patterns, and is necessary for maintaining the
accuracy in density control with a fewer patterns than the
predetermined gradation patterns, to the level equal to the accuracy in
density control with the predetermined gradation patterns in a memory;
and
10 using the data stored when controlling the image density
with fewer patterns.

146. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on a plurality of image
15 carriers onto an intermediate transfer body, and collectively transfers
the color image onto a recording medium, wherein
a method of controlling an image density is executed by using
the intermediate transfer body as the detection, the method including
forming a plurality of predetermined gradation patterns of
20 toner having different amount of toner transfer continuously on a
surface of a detection target;
detecting optically the gradation patterns by detecting
both regular reflection light and diffuse reflection light simultaneously
from the detection target;
25 performing arithmetic processing based on detecting

data of a regular reflection output and a diffuse reflection output obtained;

storing a coefficient obtained by a process for determining a value of the amount of toner transfer from among the data arithmetically processed at the arithmetic processing step, which
5 can be obtained only by detection of the predetermined gradation patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the
10 predetermined gradation patterns in a memory; and
using the data stored when controlling the image density with fewer patterns.

147. An image forming apparatus that forms a color image by
15 sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
a method of controlling an image density is executed by using the image carriers as the detection, the method including
20 forming a plurality of predetermined gradation patterns of powder having different amount of powder transfer continuously on a surface of a detection target;
detecting optically the gradation patterns;
acquiring either of detecting data and arithmetic
25 processing data based on the detecting data;

storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data acquired in a memory; and

using the data stored when controlling the image density with fewer patterns.

- 10 148. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- a method of controlling an image density is executed by using
- 15 the image carriers as the detection, the method including
- forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;
- detecting optically the gradation patterns by detecting
- 20 both regular reflection light and diffuse reflection light simultaneously from the detection target;
- performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;
- 25 storing data that is obtained only by detecting of the

predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among
5 the data obtained from the performing in a memory; and
using the data stored when controlling the image density with fewer patterns.

149. An image forming apparatus that forms a color image by
10 sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
a method of controlling an image density is executed by using the image carriers as the detection, the method including
15 forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;
detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously
20 from the detection target;
performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;
storing a coefficient obtained by a process for
25 determining a value unequivocally with respect to the amount of toner

transfer from among the data arithmetically processed at the arithmetic processing step, which can be obtained only by detection of the predetermined gradation patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the

5 predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and

using the data stored when controlling the image density with fewer patterns.

10

150. An image forming apparatus that forms a color image by sequentially superposing toner images formed on a plurality of image carriers onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

15 a method of controlling an image density is executed by using the image carriers as the detection, the method including

forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;

20 detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output

25 obtained;

storing a coefficient obtained by a process for
determining a value of the amount of toner transfer from among the
data arithmetically processed at the arithmetic processing step, which
can be obtained only by detection of the predetermined gradation
5 patterns, and is necessary for maintaining the accuracy in density
control with a fewer patterns than the predetermined gradation patterns,
to the level equal to the accuracy in density control with the
predetermined gradation patterns in a memory; and
using the data stored when controlling the image density
10 with fewer patterns.

151. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on an image carrier onto
an intermediate transfer body, and collectively transfers the color image
15 onto a recording medium, wherein

a method of controlling an image density is executed by using
the intermediate transfer body as the detection, the method including
forming a plurality of predetermined gradation patterns of
powder having different amount of powder transfer continuously on a
20 surface of a detection target;

detecting optically the gradation patterns;
acquiring either of detecting data and arithmetic
processing data based on the detecting data;
storing data that is obtained only by detecting of the
25 predetermined gradation patterns, and is necessary for maintaining

accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data acquired in a memory; and

5 using the data stored when controlling the image density with fewer patterns.

152. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto
10 an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

 a method of controlling an image density is executed by using the intermediate transfer body as the detection, the method including
 forming a plurality of predetermined gradation patterns of
15 toner having different amount of toner transfer continuously on a surface of a detection target;

 detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

20 performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;

 storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining
25 accuracy in density control with a fewer patterns than the

predetermined gradation patterns to the level equal to the accuracy in density control with the predetermined gradation patterns from among the data obtained from the performing in a memory; and

5 using the data stored when controlling the image density with fewer patterns.

153. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image
10 onto a recording medium, wherein

a method of controlling an image density is executed by using the intermediate transfer body as the detection, the method including forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a
15 surface of a detection target;

detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting
20 data of a regular reflection output and a diffuse reflection output obtained;

storing a coefficient obtained by a process for determining a value unequivocally with respect to the amount of toner transfer from among the data arithmetically processed at the arithmetic
25 processing step, which can be obtained only by detection of the

predetermined gradation patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory;
5 and
using the data stored when controlling the image density with fewer patterns.

154. An image forming apparatus that forms a color image by
10 sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
a method of controlling an image density is executed by using the intermediate transfer body as the detection, the method including
15 forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;
detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously
20 from the detection target;
performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output obtained;
storing a coefficient obtained by a process for
25 determining a value of the amount of toner transfer from among the

data arithmetically processed at the arithmetic processing step, which can be obtained only by detection of the predetermined gradation patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and using the data stored when controlling the image density with fewer patterns.

- 10 155. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein
- a method of controlling an image density is executed by using
- 15 the image carriers as the detection, the method including
- forming a plurality of predetermined gradation patterns of powder having different amount of powder transfer continuously on a surface of a detection target;
- detecting optically the gradation patterns;
- 20 acquiring either of detecting data and arithmetic processing data based on the detecting data;
- storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the
- 25 predetermined gradation patterns to the level equal to the accuracy in

density control with the predetermined gradation patterns from among the data acquired in a memory; and

using the data stored when controlling the image density with fewer patterns.

5

156. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image onto a recording medium, wherein

10 a method of controlling an image density is executed by using the image carriers as the detection, the method including

forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a surface of a detection target;

15 detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting data of a regular reflection output and a diffuse reflection output

20 obtained;

storing data that is obtained only by detecting of the predetermined gradation patterns, and is necessary for maintaining accuracy in density control with a fewer patterns than the predetermined gradation patterns to the level equal to the accuracy in

25 density control with the predetermined gradation patterns from among

the data obtained from the performing in a memory; and
using the data stored when controlling the image density
with fewer patterns.

- 5 157. An image forming apparatus that forms a color image by
sequentially superposing toner images formed on an image carrier onto
an intermediate transfer body, and collectively transfers the color image
onto a recording medium, wherein
a method of controlling an image density is executed by using
10 the image carriers as the detection, the method including
forming a plurality of predetermined gradation patterns of
toner having different amount of toner transfer continuously on a
surface of a detection target;
detecting optically the gradation patterns by detecting
15 both regular reflection light and diffuse reflection light simultaneously
from the detection target;
performing arithmetic processing based on detecting
data of a regular reflection output and a diffuse reflection output
obtained;
20 storing a coefficient obtained by a process for
determining a value unequivocally with respect to the amount of toner
transfer from among the data arithmetically processed at the arithmetic
processing step, which can be obtained only by detection of the
predetermined gradation patterns, and is necessary for maintaining the
25 accuracy in density control with a fewer patterns than the

predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and

5 using the data stored when controlling the image density with fewer patterns.

158. An image forming apparatus that forms a color image by sequentially superposing toner images formed on an image carrier onto an intermediate transfer body, and collectively transfers the color image
10 onto a recording medium, wherein

a method of controlling an image density is executed by using the image carriers as the detection, the method including

forming a plurality of predetermined gradation patterns of toner having different amount of toner transfer continuously on a
15 surface of a detection target;

detecting optically the gradation patterns by detecting both regular reflection light and diffuse reflection light simultaneously from the detection target;

performing arithmetic processing based on detecting
20 data of a regular reflection output and a diffuse reflection output obtained;

storing a coefficient obtained by a process for determining a value of the amount of toner transfer from among the data arithmetically processed at the arithmetic processing step, which
25 can be obtained only by detection of the predetermined gradation

patterns, and is necessary for maintaining the accuracy in density control with a fewer patterns than the predetermined gradation patterns, to the level equal to the accuracy in density control with the predetermined gradation patterns in a memory; and

- 5 using the data stored when controlling the image density with fewer patterns.